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(54) CONDUCTIVE PASTE AND MANUFACTURE OF MULTILAYER CERAMIC ELECTRONIC PARTS USING THE PASTE

(57)Abstract:

PURPOSE: To provide a conductive paste for thick layers which does not causes swelling and dissolution of ceramic green sheets when the paste is applied to the ceramic green sheets and provide a manufacturing method of multilayer ceramic electronic parts using the paste.

CONSTITUTION: Regarding a conductive paste which is applied to a ceramic green sheet and sintered together with the green sheet, hydrogen-added terpineol is contained in a solvent for the paste. After the conductive paste is printed on a ceramic green sheets, a plurality of the ceramic green sheets are layered and sintered.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Industrial Application]This invention relates to the manufacturing method of multilayer ceramic electronic components, such as a laminated ceramic capacitor which used the conductive paste for thick films, and this as a conductor.
[0002]
[Description of the Prior Art]Also in the multilayer ceramic electronic component produced by carrying out simultaneous calcination of the ceramic green sheet and conductive paste layers which are used for the electronic equipment, such as a laminated ceramic capacitor and a multilayered ceramic substrate, with the miniaturization of electronic equipment, the miniaturization is advanced by lamination, densification, etc.
[0003]After these multilayer ceramic electronic component prints conductive paste by screen-stencil etc. to the ceramic green sheet obtained with the doctor blade method etc. and usually laminates it to it, it is obtained by calcinating simultaneously these ceramic green sheet and conductive paste layers that were laminated. After adding and kneading organic solvents, such as binders, such as butyral resin and an acrylic resin, and toluene, as this ceramic green sheet in the end of ceramic precursor powder and considering it as slurry form, what was fabricated to the sheet shaped is used. The thing which made the organic vehicle containing a binder and solvents, such as ethyl cellulose resin and an alkyd resin, distribute conductive materials, such as metal powder, as conductive paste for this screen-stencil is used.
[0004]Conventionally, solvents, such as butylcarbitol acetate, a terpineol, and kerosene, were used as a solvent of this conductive paste (for example, JP,2-5591,A).
[0005]
[Problem(s) to be Solved by the Invention]Thus, in the conductive paste for the conventional thick films, A constant rate of conductive materials, such as metal powder, are distributed in

the organic vehicle which dissolved binder components, such as ethyl cellulose resin and an alkyd resin, in solvents, such as butylcarbitol acetate, a terpineol, or kerosene.

[0006]However, the butylcarbitol acetate, terpineol, or kerosene which is a solvent of the conductive paste for these thick films dissolves each butyral resin and acrylic resins which are the binder components of a ceramic green sheet. For this reason, while the thickness of a ceramic green sheet is comparatively thick, do not become a problem practically, but if thickness becomes thin, swelling of the ceramic green sheet by that solvent action and the dissolution will actualize, It had the problem that conductive paste layers could not be formed on a ceramic green sheet by printing and desiccation. For this reason, the lamination of a multilayer ceramic electronic component and a miniaturization had a limit.

[0007]Then, in the conductive paste for thick films, the purpose of this invention provides the conductive paste for thick films which a ceramic green sheet does not swell and dissolve, when it prints to a ceramic green sheet, and. It is in providing the manufacturing method of the multilayer ceramic electronic component using the conductive paste for the thick films.

[0008]

[Means for Solving the Problem]In order to attain the above-mentioned purpose, in conductive paste which prints and carries out simultaneous calcination on a ceramic green sheet, conductive paste of this invention contains hydrogenation terpineol acetate as a solvent component.

[0009]On a ceramic green sheet, a manufacturing method of a multilayer ceramic electronic component of this invention prints conductive paste which contains hydrogenation terpineol acetate as a solvent component, laminates these two or more ceramic green sheets, and calcinates them.

[0010]A publicly known material is used for ingredients other than a solvent in conductive paste. That is, be [what is necessary / just although calcination temperature and atmosphere of a ceramic green sheet which carry out simultaneous calcination are borne as a conductive material], as an object for laminated ceramic capacitors, powder of simple substances, such as Pd, Ag, Au, Pt, nickel, and Cu, or these mixtures, and an alloy can be used. As an object for multilayered ceramic substrates, powder of simple substances, such as Ag, Pd, and Cu, or these mixtures, and an alloy can be used. adding a plasticizer, a dispersing agent, etc. if needed to ethyl cellulose resin, alkyd resin, etc. as a binder -- a simple substance -- or it can mix and use.

[0011]And as a multilayer ceramic electronic component, there are a laminated ceramic capacitor, a lamination ceramic inductor, lamination ceramic LC parts, a multilayered ceramic substrate, etc., and these can be obtained with a publicly known manufacturing method using conductive paste of this invention. That is, conductive paste of this invention is applied to a ceramic green sheet obtained, for example with a doctor blade method etc. with screen

printing etc., and conductive paste layers are formed. Next, required number-of-sheets lamination is carried out, and it is stuck by pressure, and is considered as a layered product so that it may become a desired structure. Then, after carrying out simultaneous calcination of the layered product of this ceramic green sheet of this and conductive paste layers and obtaining lamination ceramics, it processes that exterior electrodes are applied and it can be printed etc., and a multilayer ceramic electronic component is obtained.

[0012]

[Function]Hydrogenation terpineol acetate is used for the conductive paste of this invention as a solvent. This solvent does not dissolve butyral resin or the acrylic resin which are the binder components of a ceramic green sheet. Therefore, after printing conductive paste on a ceramic green sheet, a ceramic green sheet does not change by swelling, the dissolution, etc.

[0013]

[Example]Hereafter, the example of this invention is described about the case of a laminated ceramic capacitor. First, the binder which consists of ethyl cellulose resin and an alkyd resin was dissolved in hydrogenation terpineol acetate 10% of the weight, and the organic vehicle for conductive paste was prepared. Next, the organic vehicle previously prepared for Pd powder was added 40% of the weight, and it kneaded with 3 rolls, and was considered as Pd paste. Similarly also about each solvent of butylcarbitol acetate, a terpineol, and kerosene. After dissolving 10% of the weight of the binder which consists of ethyl cellulose resin and an alkyd resin and preparing the organic vehicle for conductive paste, it added 40% of the weight to Pd powder, respectively, and it kneaded with 3 rolls, was considered as Pd paste, respectively, and was considered as the comparative example.

[0014]On the other hand, each organic binder of butyral resin or an acrylic resin and the organic solvent of toluene were added and kneaded in the end of $BaTiO_3$ system ceramic precursor powder, and the slurry was prepared. Then, this slurry was fabricated to the sheet shaped and the ceramic green sheet (20 micrometers in thickness which used butyral resin or an acrylic resin as the organic binder, 10 micrometers, and 5 micrometers) was produced.

[0015]Then, the whole surface of the ceramic green sheet was made to print and dry each Pd paste prepared previously with screen printing, and conductive paste layers were formed. Then, the ceramic green sheet covered with conductive paste layers was observed by viewing from the rear face, and the dissolution degree of the ceramic green sheet was checked by a deformation degree and tone.

[0016]The result of having checked ceramic green sheet thickness for the dissolution degree of the ceramic green sheet for every combination of the solvent of conductive paste and the binder of a ceramic green sheet as a parameter is shown in Table 1. When the hydrogenation terpineol acetate of this invention is used as the solvent of conductive paste as for a passage clearer than Table 1, a ceramic green sheet swells and does not dissolve. Namely, when

conventional butylcarbitol acetate, terpineol, or kerosene is used as a solvent. When ceramic green sheet thickness was set to 10 micrometers or less and the hydrogenation terpineol acetate of this invention is used as a solvent to swelling and the dissolution of a ceramic green sheet actualizing, as for swelling or the dissolution, at least 5 micrometers of thickness of the ceramic green sheet are not accepted.

[0017]It is shown that it can be calcinated after this thing prints and laminates the conductive paste of this invention on a ceramic green sheet thinner than before, and it can manufacture a multilayer ceramic electronic component.

[0018]

[Effect of the Invention]After printing the conductive paste of this invention on a ceramic green sheet, it is not made to transform a ceramic green sheet by swelling, the dissolution, etc. by the above explanation, so that clearly. Therefore, in the multilayer ceramic electronic component produced by carrying out simultaneous calcination of a ceramic green sheet and conductive paste layers, such as a laminated ceramic capacitor, a ceramic layer can be made into a thin layer more than former. For this reason, it becomes possible to obtain small size and a high-density multilayer ceramic electronic component more.

[0019]

[Table 1]

	試料番号	導電性ペーストの溶剤	グリーンシート		確認結果
			バインダー	厚み（μm）	
本発明例	1	水素添加テルピネオール	ブチラール	20	不溶
	2	アセテート	樹脂	10	不溶
	3			5	不溶
	4		アクリル	20	不溶
	5		樹脂	10	不溶
	6			5	不溶
従来例	7	ブチルカルビトール	ブチラール	20	不溶
	8	アセテート	樹脂	10	膨潤
	9			5	溶解
	10		アクリル	20	不溶
	11		樹脂	10	膨潤
	12			5	溶解
	13	テルピネオール	ブチラール	20	不溶
	14		樹脂	10	膨潤
	15			5	溶解
	16		アクリル	20	不溶
	17		樹脂	10	膨潤
	18			5	溶解
	19	ケロシン	ブチラール	20	不溶
	20		樹脂	10	溶解
	21			5	溶解
	22		アクリル	20	不溶
	23		樹脂	10	膨潤
	24			5	溶解

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CLAIMS

[Claim(s)]
[Claim 1]Conductive paste containing hydrogenation terpineol acetate as a solvent component in conductive paste which prints and carries out simultaneous calcination on a ceramic green sheet.
[Claim 2]A manufacturing method of a multilayer ceramic electronic component printing conductive paste which contains hydrogenation terpineol acetate as a solvent component, laminating these two or more ceramic green sheets, and calcinating them on a ceramic green sheet.

[Translation done.]